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SRM Name: ICTA Temperature Standards
(295 - 675 °C)
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MATERIAL SAFETY DATA SHEET PACKET

National Institute of Standards and Technology
Standard Reference Materials Program
Gaithersburg, Maryland 20899
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RM 8759 is a set of five reference materials for calibration of temperatures scales under the dynamic temperature conditions in differential thermal analysis, differential scanning calorimetry and related techniques and for interlaboratory comparison of data. RM 8759 is a set containing the following materials:

Potassium Perchlorate

Silver Sulfate

Quartz

Potassium Sulfate

Potassium Chromate

Potassium Perchlorate

SECTION I. MATERIAL IDENTIFICATION

Material Name: Potassium Perchlorate

Description: The set contains 10 grams of potassium perchlorate.

Other Designations: potassium hyperchlorate, potassium hyperchloride, perchloric acid potassium salt, *Perchlorate, Peroidin*

Chemical Formula: KClO_4

CAS Reg. No.: 7778-74-7

DOT Classification: Small Quantity Exception

Manufacturer/Supplier: Available from a number of suppliers.

Trade Names

SECTION II. HAZARDOUS INGREDIENTS

<u>Hazardous Component</u>	<u>Nominal Concentration</u>	<u>Limits and Toxicity Data</u>
Potassium Perchlorate	~ 100%	No TLV-TWA established. No toxicity data available.

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Potassium Perchlorate

Appearance and Odor: Colorless crystals or white powder.

Molecular Weight: 138.55

Density: 2.52

Melting Point: Decomposes at 610 °C.

Solubility in Water: Soluble in 65 parts cold water.
Soluble in 15 parts boiling water.

Solubility in Other Compounds: Very slightly soluble in alcohol.
Insoluble in ether.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Extinguishing Media: This material is non-flammable. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Unusual Fire and Explosion Hazards: Potassium perchlorate is a negligible fire and explosion hazard when exposed to heat or flame. However, this material is an oxidizer and oxidizers decompose especially when heated, to yield oxygen or other gases which will increase the burning rate of combustible matter. Contact with easily oxidizable, organic or other combustible materials may result in ignition, violent combustion or explosion.

Potassium perchlorate will form ignition and/or explosion hazards with the following materials:

Ignition Reaction

aluminum + aluminum fluoride (increases the ease of ignition)
antimony
arsenic
barium chromate + tungsten and/or titanium
boron + magnesium + silicone rubber (ignites with heat)
combustible materials (fire and explosion hazard)
magnesium (fire and explosion hazard)
molybdenum (may ignite at 330 °C)
potassium hexacyanocobaltate (3-) (mixture serves as gasless pyrotechnic compositions)
titanium hydride (pyrotechnic mixture)

Explosion Reaction

aluminum + barium nitrate + potassium nitrate + water (the mixture exploded after 24 hours storage under water)
aluminum + magnesium
aluminum powder + titanium dioxide (the mixture exploded violently during mixing)
cotton lint (explosion hazard at 245 °C)
ethanol (explosion hazard with heat)
ethylene glycol (explosion hazard at 245 °C)
fluorine (may produce an explosive, unstable compound)
furfural (explosion hazard at 270 °C)
hydrazine (may explode)
lactose (may explode)
metals (when perchlorates are mixed with finely divided metals the mixture may be explosive)
nickel + titanium
nickel powder (friction sensitive, causing severe explosions)
reducing agents
sulfur (may be exploded by moderate impact)

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid excessive temperatures.

Incompatibility (Materials to Avoid): Potassium perchlorate with ferrocenium diamminetetraakis (thiocyanato-n)chromate (1-) increases the rate of thermal decomposition.

See Section IV: Fire and Explosion Hazard Data.

Hazardous Decomposition or Byproducts: Thermal decomposition releases toxic fumes of chlorine and oxides of potassium.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Inhalation of potassium perchlorate may cause nasal and respiratory irritation with sneezing and coughing. Skin and eye irritation may cause irritation. Prolonged skin contact may cause *dermatitis* (inflammation of the skin) and continued eye exposure may cause *conjunctivitis* (inflammation of the conjunctiva).

Perchlorates may cause nausea, vomiting, abdominal pain, diarrhea, and *methemoglobinemia* (the presence of methemoglobin, a soluble, brown, crystalline blood pigment that differs from hemoglobin in that it contains ferric iron and is unable to combine reversibly with molecular oxygen) with *hemolytic anemia* (anemia caused by excessive destruction [as in chemical poisoning, infection or sickle-cell anemia] of red blood cells). Other effects may include liver, kidney and bone marrow effects. Repeated exposure may lead to bone marrow damage resulting in *pancytopenia* (an abnormal reduction in the number of erythrocytes, leukocytes and blood platelets in the blood) and multiple cytopenia. Fatal *aplastic anemia* has occurred in at least four patients. Other effects reported include kidney damage and lymph node disease. Animals fed potassium perchlorate as 1% of their diet for 83 days exhibited reduced growth rate and depleted thyroid iodine. Fetal abnormalities have been reported from prolonged oral administration to rats, rabbits and guinea pigs during pregnancy.

Signs and Symptoms of Exposure: See section VI: Health Hazards (Acute and Chronic).

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

TARGET ORGAN(S) OF ATTACK: Poisoning may effect the blood.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Evacuate all nonessential personnel. Avoid raising dust. Recover small spills with a clean shovel, and place into a clean, dry container for later disposal. Remaining residue should be cleaned up using a high efficiency particulate filter.

Waste Disposal: Follow all Federal, state and local regulations.

Handling and Storage: Persons handling this material should wear an air-purifying respirator with a high-efficiency particulate filter. The specific respirator selected must be based on contamination levels found in the workplace, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Additional protective clothing such as gloves, lab coats and splash-proof or dust-resistant safety goggles should be worn.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a cool, dry, well ventilated area and protect containers from physical damage.

Silver Sulfate

SECTION I. MATERIAL IDENTIFICATION

Material Name: Silver Sulfate

Description: The set contains 3 grams of reagent grade silver sulfate.

Other Designations: N/A

Chemical Formula: Ag₂SO₄

CAS Reg. Nos.: 10294-26-5

DOT Classification:

Manufacturer/Supplier: Available from a number of suppliers.

SECTION II. HAZARDOUS INGREDIENTS

<u>Hazardous Component</u>	<u>Nominal Concentration</u>	<u>Limits and Toxicity Data</u>
Silver Sulfate	100%	OSHA TLV-TWA: 0.01 mg/m ³ ACGIH TLV-TWA: 0.01 mg/m ³ NIOSH Recommended TWA: 0.01 mg/m ³ DFG MAK TWA: 0.01 mg/m ³

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Silver Sulfate

Appearance and Odor: Small colorless crystals or crystalline powder that turns gray on exposure to light.

Molecular Weight: 311.8

Density: 5.5

Boiling Point: 1085 °C; decomposes.

Melting Point: 657 °C

Solubility in Water: Soluble in 125 parts cold water; 71 parts boiling water.

Solubility in Other Compounds: Soluble in nitric acid, ammonia ammonium hydroxide and concentrated sulfuric acid.

Insoluble in alcohol.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Extinguishing Media: This material is non-flammable. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Unusual Fire and Explosion Hazards: No unusual fire or explosion hazards reported.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid heating to decomposition.

Incompatibility (Materials to Avoid): No reported incompatibilities.

Hazardous Decomposition or Byproducts: Thermal decomposition may release toxic oxides of sulfur.

Hazardous Polymerization: Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Exposure to silver compounds, either through inhalation, skin and/or eye contact or ingestion may cause *argyria*, which is characterized by blue discoloration of the skin, mucous membranes and eyes.

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	<u> </u>	<u> X </u>
In the International Agency for Research (IARC) Monographs	<u> </u>	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	<u> </u>	<u> X </u>

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

TARGET ORGAN(S) OF ATTACK: The skin and mucous membranes.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Evacuate all nonessential personnel. Avoid raising dust. Recover small spills with a clean shovel, and place into a clean, dry container for later disposal. Remaining residue should be cleaned up using a high efficiency particulate filter.

Waste Disposal: Follow all Federal, state and local regulations.

Handling and Storage: Persons handling this material should wear an air-purifying respirator with a high-efficiency particulate filter. The specific respirator selected must be based on contamination levels found in the workplace, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Additional protective clothing such as gloves, lab coats and splash-proof or dust-resistant safety goggles should be worn.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a cool, dry, well ventilated area and protect containers from physical damage.

Quartz

SECTION I. MATERIAL IDENTIFICATION

Material Name: Quartz

Description: This set contains 3 grams of natural quartz.

Other Designations: silicon dioxide, sand, rose quartz, natural quartz, silicic anhydride, amethyst, silica, agate, flint, chalcedony, silica flour, crystalline silica

Chemical Formula: SiO₂

CAS Reg. No.: 14808-60-7

DOT Classification: Not hazardous by DOT regulations.

Manufacturer/Supplier: Available from a number of suppliers.

SECTION II. HAZARDOUS INGREDIENTS

<u>Hazardous Component</u>	<u>Nominal Concentration</u>	<u>Limits and Toxicity Data</u>
Quartz	~ 100%	<p>OSHA PELs-TWA:* 10 mg/m³ divided by (%SiO₂ + 2)</p> <p>30 mg/m³ divided by (%SiO₂ + 2) (total dust)</p> <p>ACGIH TLV-TWA: 0.1 mg/m³</p> <p>NIOSH REL-TWA: 50 µg/m³</p> <p>Human, Inhalation: TCLO: 16 mppcf if air administered intermittently during 8 hr periods over 17.9 years produces pulmonary fibrosis, cough and difficulty breathing.</p> <p>Human, Inhalation: LCLO: 300 µg/m³ administered intermittently over a 10 year period affects the liver.</p> <p>Rat, Intratracheal: LDLO: 200 mg/kg</p> <p>Rat, Intravenous: LDLO: 90 mg/kg</p> <p>Mouse, Intravenous: LDLO: 40 mg/kg</p> <p>Dog, Intravenous: LDLO: 20 mg/kg</p>

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Quartz

Appearance and Odor: An odorless, tasteless, transparent hexagonal crystal or amorphous powder.

Molecular Weight: 60.09

Density: 2.635 - 2.660

Boiling Point: 2230 °C

Melting Point: 1610 °C

Vapor Pressure (at 1732 °C): 10mm

Mohs Hardness: 7

Solubility in Water: Insoluble.

Solubility in Other Compounds: Soluble in hydrofluoric acid; very slightly soluble in alkalis and hot concentrated phosphoric acid.

Insoluble in most acids and organic solvents.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A

LOWER: N/A

Extinguishing Media: This material is noncombustible. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Unusual Fire and Explosion Hazards: Upon heating at high temperatures, quartz combines chemically with many metal oxides. Explosions are possible with chlorine trifluoride, oxygen trifluoride, metals, and ozone in the presence of organic materials. Detonation is possible with quartz + xenon hexafluoride.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid excessive temperatures and strong oxidizing materials.

Incompatibility (Materials to Avoid): Quartz dissolves readily in hydrofluoric acid creating an exothermic reaction and forming silicon tetrafluoride, a corrosive gas. It reacts violently with powerful oxidizers such as chlorine trifluoride, manganese trifluoride, oxygen difluoride, vinylacetate, and certain other fluorine-containing compounds. It is attacked by strong alkalis and hydrofluoric acid. Possible detonation occurs with xenon hexafluoride.

Hazardous Decomposition or Byproducts: When exposed to high temperatures, amorphous silica can change its crystal structure to form *tridymite* (above 870 °C) or *cristobalite* (above 1470 °C), which have a greater health hazard than quartz.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

***Note:** Inhalation is the primary route of entry.

Health Hazards (Acute and Chronic): Immediate exposure to high concentrations may cause physical discomfort of the upper respiratory tract; contact with the skin can cause irritation due to mechanical abrasion of the dermis. Data of acute eye contact is limited to animal studies. Particles of silica in the range of 2 - 3 micrometers introduced into the *corneal stroma* (the spongy protoplasmic framework of the transparent part of the coat of the eyeball) of rabbit eyes cause little reaction. Chronic exposure to the eye shows an abnormally high silicon content in the *cornea* and a gradual decrease in visual acuity due to *corneal opacities* in the *pupillary* (of the contractile round aperture in the iris of the eye) area has been reported in foundry workers who developed *pulmonary silicosis*. These same particles introduced into the *anterior chamber* cause an inflammatory reaction in 3 - 5 weeks with the formation of *fibrotic nodules* (bundles of fibrotic tissue) in the *iridocorneal angle*. Finely divided silica injected into the *vitreous humor* (the clear, colorless, transparent jelly that fills the eyeball posterior to the lens) of the rabbit eyes has caused *necrosis* (localized death of living tissue) of the *retina* (the sensory membrane that lines the eye, receives the image formed by the lens, is the immediate instrument of vision, and is connected with the brain by the optic nerve) and *atrophy* (wasting away of tissue) of the *choroid* (a vascular membrane containing large branched pigment cells that lie between the retina and the sclera of the vertebrate eye).

The extended inhalation of dusts containing free silica may result in the disabling *pulmonary fibrosis* known as *pulmonary silicosis*. The Committee on Pneumoconiosis of the American Public Health Association defines *silicosis* as "a disease due to the breathing of air containing silica (SiO_2), characterized by generalized fibrotic changes and the development of miliary nodules in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis (some or all of which symptoms may be present), and characterized by x-ray findings."

The duration of exposure which is associated with the development of *silicosis* varies widely for different occupations. There is also much variation in individual susceptibility. The action of silica on the lungs results in the production of a diffuse, *nodular fibrosis* in which the *parenchyma* (the essential and distinctive tissue of an organ) and the *lymphatic system* are involved. The *fibrosis*, to a certain extent, is progressive and may continue to increase for several years after exposure is terminated. Where the pulmonary reserve is sufficiently reduced, shortness of breath is often a symptom of exposure. This is the first and often most common symptom in cases of uncomplicated silicosis. If severe, it may incapacitate the worker for heavy or even light physical exertion. In extreme cases, there may be shortness of breath even while at rest.

Responses to cristobalite appear to be more severe than from quartz, and the *fibrosis* that follows is more progressive than uncomplicated *silicosis*. Studies show that lung cancer occurs more frequently among silicotics (i.e. miners, quarry, foundry, ceramic and granite workers, and stone cutters) than in the general population. Studies are still inconclusive at this time.

The effects of ingestion are due to the mechanical action as crystalline silicas are biologically inert.

Signs and Symptoms of Exposure: The most common physical sign of *silicosis* is the limitation of expansion of the chest. Further progress of the disease results in marked fatigue, and the total incapacity to work. Chronic exposure by inhalation, to high concentrations of finely divided crystalline silica dust, ranging in exposure periods of a few weeks to 4 - 5 years, may cause a rapidly developing *silicosis*, characterized by *pulmonary insufficiency* with severe *dyspnea* (difficult or labored respiration), violent coughing, *tachypnea*, weight loss and *cyanosis* (the bluish or purplish discoloration of the skin due to deficient oxygenation of the blood) leading to the development of *cor pulmonale* (disease of the heart characterized by hypertrophy and dilatation of the right ventricle and secondary to disease of the lungs or their blood vessels) and death within a short period of time. Death can result

from cardiac failure or from the destruction of lung tissue, with resultant *anoxia* (a deficiency of oxygen reaching the tissues of the body of such severity as to result in permanent damage). There is no fever or other evidence of systemic reaction. Many cases are complicated by respiratory infections. In late stages, the x-ray may show large conglomerate shadows, due to the coalescence of the silicotic nodules, with area of *emphysema* (a condition of the lung marked by abnormal dilation of its air spaces and distension of its walls and frequently by impairment of heart action) between them.

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	<u>X*</u>	—
In the International Agency for Research (IARC) Monographs	<u>X**</u>	—
By the Occupational Safety and Health Administration (OSHA)	—	<u>X</u>

*NTP classifies silicon dioxide as an *anticipated human carcinogen*.

**IARC states that there is "*sufficient evidence for the carcinogenicity of crystalline silica to experimental animals*" and "*limited evidence*" with respect to humans.

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

TARGET ORGAN(S) OF ATTACK: The skin, eyes, upper respiratory track.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Provide adequate ventilation. Cleanup personnel need protection against eye and skin contact and dust inhalation. Use dustless systems for cleanup so that airborne dust does not exceed the PEL. Do not dry sweep. Carefully clean up spills without generating dust clouds and place waste in suitable containers for disposal.

Waste Disposal: Contact a licensed contractor for detailed recommendations. Follow all Federal, state and local regulations.

Handling and Storage: Wear protective eyeglasses or chemical safety goggles. Use gloves, aprons, and other protective clothing to prevent skin contact. Protect the skin with barrier creams. Wear a NIOSH approved respirator for exposures above the TLV. The specific respirator selected must be based on contamination levels found in the workplace, must not exceed the working limits of the respirator and be jointly approved by The National Institute for Occupational Safety and Health and The Mine Safety and Health Administration (NIOSH-MSHA).

Quartz

Concentrations	Respirator
0.25 mg/m ³	Any dust and mist respirator.
0.05 mg/m ³	Any dust and mist respirator except single-use and quarter mask respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
1.25 mg/m ³	Any powered air-purifying respirator with a dust and mist filter.
2.5 mg/m ³	Any air-purifying full facepiece respirator with a high efficiency particulate filter. Any self-contained breathing apparatus with a full facepiece. Any powered air-purifying respirator with a tight fitting facepiece and a high-efficiency particulate filter. Any supplied-air respirator with a full facepiece. Any powered air-purifying respirator with a tight fitting facepiece operated in a continuous flow mode.
50 mg/m ³	Any supplied-air respirator with a half mask and operated in a pressure-demand or other positive pressure mode.
100 mg/m ³	Any supplied-air respirator with a half mask and operated in a pressure-demand or other positive pressure mode.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a well ventilated area. Keep material dry and protect containers from physical damage.

Potassium Sulfate

SECTION I. MATERIAL IDENTIFICATION

Material Name: Potassium Sulfate

Description: The set contains 10 grams of reagent grade potassium sulfate.

Other Designations: natural arcanite, sal polychrestum, arcanum duplicatum, tartarus vitriolatus, potassium sulphate, dipotassium sulfate, sulfuric acid dipotassium salt

Chemical Formula: K_2SO_4

CAS Reg. No.: 7778-80-5

DOT Classification: Not hazardous by DOT regulations.

Manufacturer/Supplier: Available from a number of suppliers.

SECTION II. HAZARDOUS INGREDIENTS

<u>Hazardous Component</u>	<u>Nominal Concentration</u>	<u>Limits and Toxicity Data</u>
Potassium Sulfate	~ 100%	No TLV-TWA established. Woman, Oral: LD _{LO} : 750 mg/kg Rat, Oral: LD ₅₀ : 6600 mg/kg Guinea Pig, Subcutaneous: LD _{LO} : 3000 mg/kg

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Potassium Sulfate

Appearance and Odor: Colorless or white, odorless, hard, bitter crystals, or white granules or powder; permanent in air.

Molecular Weight: 174.25

Density: 2.662

Boiling Point: 1689 °C

Melting Point: 1067 °C

Solubility in Water: One gram dissolves in 8.3 ml water.
One gram dissolves in 4 ml boiling water.

Water solubility of potassium sulfate is decreased by KCl or $(NH_4)_2SO_4$.

Solubility in Other Compounds: One gram dissolves in 75 ml of glycerol.

Insoluble in alcohol, acetone and carbon disulfide.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Extinguishing Media: This material is non-flammable. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Unusual Fire and Explosion Hazards: Potassium sulfate is a negligible fire and explosion hazard when exposed to heat and/or flame. Potassium sulfate with aluminum will produce a violent explosion on melting.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid excessive temperatures.

Incompatibility (Materials to Avoid): No known incompatibility reactions occur with this material.

See Section IV: Fire and Explosion Hazard Data.

Hazardous Decomposition or Byproducts: Thermal decomposition may release toxic oxides of sulfur.

Hazardous Polymerization: Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Inhalation of potassium sulfate may cause irritation of the upper respiratory tract. Levels exceeding 10 µg/m³ of suspended sulfates in the air may cause an excess risk of asthmatic attacks in susceptible individuals. Skin and eye contact may cause irritation.

Acute potassium poisoning by ingestion is rare because large, single doses usually induce vomiting, severe gastrointestinal irritation, and catharsis, and because in the absence of pre-existing kidney damage, potassium is rapidly excreted. However, if sufficient amounts are absorbed, potassium may disturb the rhythm of the heart causing a slow, weak pulse, arrhythmias and a fall in blood pressure. Respirations are initially accelerated but skeletal muscle weakness may advance to the stage of paralysis.

Signs and Symptoms of Exposure: See section VI: Health Hazards (Acute and Chronic).

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u>X</u>
In the International Agency for Research (IARC) Monographs	_____	<u>X</u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u>X</u>

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

TARGET ORGAN(S) OF ATTACK: Poisoning may effect the heart.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Evacuate all nonessential personnel. Avoid raising dust. Recover small spills with a clean shovel, and place into a clean, dry container for later disposal. Remaining residue should be cleaned up using a high efficiency particulate filter.

Waste Disposal: Follow all Federal, state and local regulations.

Handling and Storage: Persons handling this material should wear an air-purifying respirator with a high-efficiency particulate filter. The specific respirator selected must be based on contamination levels found in the workplace, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Additional protective clothing such as gloves, lab coats and splash-proof or dust-resistant safety goggles should be worn.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a cool, dry, well ventilated area and protect containers from physical damage.

Potassium Chromate

SECTION I. MATERIAL IDENTIFICATION

Material Name: Potassium Chromate

Description: The set contains 10 grams of reagent grade potassium chromate.

Other Designations: chromate of potash, tarapacaite, bipotassium chromate, dipotassium chromate, dipotassium monochromate, neutral potassium chromate

Chemical Formula: CrK_2O_4

CAS Reg. No.: 7789-00-6

DOT Classification: Not hazardous by DOT regulations.

Manufacturer/Supplier: Available from a number of suppliers.

SECTION II. HAZARDOUS INGREDIENTS

<u>Hazardous Component</u>	<u>Nominal Concentration</u>	<u>Limits and Toxicity Data</u>
Potassium Chromate	~ 100%	ACGIH TLV-TWA: 0.05 mg(Cr)/m ³ OSHA Ceiling Limit: 0.01 mg(CrO ₃)/m ³ NIOSH TLV-TWA: 0.001 mg(Cr(VI))/m ³ Mouse, Oral: LD ₅₀ : 180 mg/kg Mouse, Intraperitoneal: LD ₅₀ : 32 mg/kg Guinea Pig, Subcutaneous: LD _{LO} : 60 mg/kg Rabbit, Subcutaneous: LD _{LO} : 12 mg/kg Rabbit, Intramuscular: LD ₅₀ : 11 mg/kg Dog, Subcutaneous: LD _{LO} : 19 mg/kg Dog, Intravenous: LD _{LO} : 2900 µg/kg

SECTION III. PHYSICAL/ CHEMICAL CHARACTERISTICS

Potassium Chromate

Appearance and Odor: Odorless, yellow crystals.

Molecular Weight: 194.20

Density: 2.732

Melting Point: 975 °C

Solubility in Water: Soluble in 1.6 parts cold water.
Soluble in 1.2 parts hot water.

Solubility in Other Compounds: Insoluble in alcohol.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

(Method Used): N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): UPPER: N/A
LOWER: N/A

Extinguishing Media: This material is non-flammable. Use extinguishing media that is appropriate to the surrounding fire.

Special Fire Procedures: Since the fire may produce toxic fumes, wear a self contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Unusual Fire and Explosion Hazards: Potassium chromate is a negligible fire and explosion hazard when exposed to heat or flame. However, this material is an oxidizer and oxidizers decompose especially when heated, to yield oxygen or other gases which will increase the burning rate of combustible matter. Contact with easily oxidizable, organic or other combustible materials may result in ignition, violent combustion or explosion.

Potassium chromate with hydrazine will form an explosion hazard.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid contact with combustible materials.

Incompatibility (Materials to Avoid): Potassium chromate is incompatible with reducing agents.

See Section IV: Fire and Explosion Hazard Data.

Hazardous Decomposition or Byproducts: Thermal decomposition products may include toxic and hazardous oxides of potassium and chromium.

Hazardous Polymerization: Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Inhalation of levels reaching 30 mg/m³ (chromium) are immediately dangerous to life and health. Inhalation of chromate dusts may cause severe nose and throat irritation, coughing, labored breathing, wheezing, chest pain, *laryngitis*, nosebleeds and *rhinitis* (inflammation of the mucous membrane of the nose). Allergic bronchitis may occur in previously exposed persons. Prolonged or repeated exposure to chromate dusts may cause chronic respiratory tract irritation with congestion, *hypermia* (excess blood in a body part) and polyps, *rhinitis*, *nasal septum ulceration and perforation*, *laryngeal congestion*, *emphysema* (a condition of the lungs characterized by abnormal dilation of its air spaces and distension of its walls and frequently by impairment of heart action), *tracheitis* (inflammation of the *trachea* - the main trunk of the system of tubes by which air passes to and from the lungs in vertebrates), *chronic bronchitis* (persistent inflammation of the bronchial tubes), *bronchopneumonia*, *pneumoconiosis* (a disease of the lungs caused by the habitual inhalation of irritant materials), fatigue, lassitude, gastrointestinal disorders, liver and kidney damage, and *pulmonary sensitization*. An excess risk for lung and sinonasal cancer has been reported in workers in the chromate production, chromate pigment production and chromium plating industries.

Skin contact with chromate dusts may cause severe irritation, skin ulceration and sensitization *dermatitis* (inflammation of the skin) in previously exposed persons. The ulcers usually occur on the hands, forearms and feet where the skin has been abraded or broken, and are relatively painless, heal slowly and produce a depressed scar. Allergic eruptions may be oozing, or may be dry, fissured and lichenified. Chromates that become imbedded in the skin may result in a *granulomatous* (a mass or nodule of chronically inflamed tissue with granulations that is usually associated with an infective process) reaction. Prolonged or repeated exposure to chromate dusts may result in chromate sensitivity. Chronic chromate dermatitis may continue for many years after cessation of exposure.

Eye contact with chromate dusts may cause redness, lacrimation, severe irritation and *conjunctivitis* (inflammation of the conjunctiva). Repeated or prolonged exposure can lead to conjunctivitis.

Ingestion of small amounts of chromate dusts may induce or aggravate eczema in chromate-sensitive persons. Ingestion of large amounts may cause nausea, vomiting, violent *gastroenteritis* (inflammation of the lining membrane of the stomach and intestines), *hypertrophy* (an increase in size or bulk) and ulceration. Repeated or prolonged ingestion of chromates may cause gastric cancers, gastrointestinal ulcers and blood changes including *leukocytosis* (an increase in the number of white or colorless nucleated cells that occur in the blood) or *leukopenia* (a condition in which the number of leucocytes, any of the white or colorless nucleated cells that occur in the blood, circulating in the blood is abnormally low), *monocytosis* and *eosinophilia* (an abnormal increase in the number of leukocytes or other granulocytes with cytoplasmic inclusions, that is characteristic of allergic states and various parasitic infections). Incorporation of 5 µg/g of hexavalent chromium compounds into the drinking water of mice over their lifetimes produced a slightly higher incidence of malignant tumors than in controls.

Chromate compounds are considered carcinogens. An excess risk for lung and sinonasal cancer has been reported in workers in the chromate production, chromate pigment production and chromium plating industries.

Signs and Symptoms of Exposure: See section VI: Health Hazards (Acute and Chronic).

Medical Conditions Generally Aggravated by Exposure: N/A

Listed as a Carcinogen/Potential Carcinogen:

	<u>Yes</u>	<u>No</u>
In the National Toxicology Program (NTP) Report on Carcinogens	<u>X</u>	—
In the International Agency for Research (IARC) Monographs	<u>X</u>	—
By the Occupational Safety and Health Administration (OSHA)	<u>X</u>	—

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Contact medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Contact medical assistance if necessary.

Inhalation: If inhaled, remove the victim to fresh air. If breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration. Contact medical assistance if necessary.

Ingestion: If ingested, wash out mouth with water. Contact medical assistance if necessary.

Note to Physician: The following antidote has been recommended, however, the decision as to whether the severity of poisoning requires administration of any antidote and the actual dose required should be made by qualified medical personnel.

Chromium Poisoning:

The use of dimercaprol has been suggested on the basis of findings in animals. Give 3 mg/kg every 4 hours, intramuscularly for the first 2 days and then 2 mg/kg every 12 hours for a total of 10 days. Antidote should be administered by qualified medical personnel.

TARGET ORGAN(S) OF ATTACK: Potassium chromate is a skin sensitizer.

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of major spills and/or leaks. Evacuate all nonessential personnel. Avoid raising dust. Recover small spills with a clean shovel, and place into a clean, dry container for later disposal. Remaining residue should be cleaned up using a high efficiency particulate filter.

Waste Disposal: Follow all Federal, state and local regulations.

Handling and Storage: Persons handling this material should wear an air-purifying respirator with a high-efficiency particulate filter. The specific respirator selected must be based on contamination levels found in the workplace, must be based on the specific operation, must not exceed the working limits of the respirator and must be jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Additional protective clothing such as gloves, lab coats and splash-proof or dust-resistant safety goggles should be worn.

Note: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the lab.

Store material in a cool, dry, well ventilated area and protect containers from physical damage.

SECTION VIII. SOURCE DATA/ OTHER COMMENTS

Sources: Genium Publishing Corporation, MSDS No. 71, *Quartz*, April, 1990.
Occupational Health Services, Inc., *Quartz*, July 12, 1990.
Occupational Health Services, Inc., *Quartz*, March 24, 1993.
Occupational Health Services, Inc., *Potassium Sulfate*, March 24, 1993.
Occupational Health Services, Inc., *Potassium Chromate*, March 24, 1993.
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Occupational Health Services, Inc., *Potassium Perchlorate*, March 24, 1993.
Dangerous Properties of Industrial Materials, 5th ed., 1979.
Hawley's Condensed Chemical Dictionary, 11th ed., 1987.
Handbook of Chemistry and Physics, 70th ed., 1989 - 1990.
The Merck Index, 11th ed., 1989.
Webster's Ninth New Collegiate Dictionary, 1990.

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Note: Physical and chemical data contained in this MSDS are provided for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references, however NIST does not certify the data on the MSDS. The certified values for this material are given only on the NIST Certificate of Analysis.